

Electrolysis of Water

The following content is based on material from the Canadian National Chemistry Week Website:

Objective:

The purpose is to electrolyze water by applying a current through electrodes with a 9V battery. Electrolysis is a process by which a chemical reaction is carried out by means of the passage of an electric current. In the electrolysis of water, water is oxidized at the anode (negative) and reduced at the cathode (positive).



equation simplified to: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$

The cathode will be recognized by a pink color from the phenolphthalein indicator due to hydroxide (OH^-) production. Phenolphthalein turns pink in the presence of base (OH^-) and clear in the presence of acid (H^+). Both electrodes will produce bubbles; however, the **cathode** will be recognized due to the greater production of gas. Two molecules of hydrogen are produced for every molecule of oxygen produced. The gases produced at the electrodes can also be collected and tested. A positive test for the presence of hydrogen is a soft pop sound when a burning match is placed in the mouth of the container. The test for the presence of oxygen is to place a smoldering match in the mouth of the container. If the match glows oxygen is present.

Materials:

- * 9V battery
- * matches
- * crucible tongs
- * electrical wire (insulated) with alligator clips
- * 400 mL glass beaker

- * two J-electrode
- * two test tubes
- * sodium sulfate
- * phenolphthalein indicator

Procedure:

1. Clip a wire to one tip of each J-shaped electrode.
2. Prepare 500 mL of 1M sodium sulfate solution.
3. Fill a 400 mL beaker with approximately 300 mL of 1M sodium sulfate solution
4. Fill both test tubes with the remaining 1M sodium sulfate solution.
5. Carefully invert the test tubes and place them in the beaker. Attach them upright to the sides with clips.
6. Place an electrode inside each test tube and attach the other ends of the wires to the battery.
7. Observe the gas collecting at the top of the test tubes.
8. The addition of some phenolphthalein indicator to the solution will determine which electrode is the cathode. A pink color around the cathode will be seen due to the production of hydroxide and hydrogen.

Test for H₂

1. Remove the test tube from the water and keep it inverted.
2. While holding a match in the tongs light it and place it in the mouth of the test tube containing the hydrogen.
3. A soft pop sound indicates hydrogen is present.

Test for O₂

1. Remove the test tube and cover with the lid (cardboard) quickly.
2. Turn the test tube right side up (a small amount of water in the test tube is O.K.).
3. While holding a match in tongs, light it and then blow it out.
4. Remove the lid from the test tube and place the smoldering match in the test tube.
5. If the toothpick glows then oxygen is present.